Information Request NSTAR-SEBANE-1-1

Please provide copies of (1) any and all prefiled testimony or reports (including all associated exhibits and attachments) submitted by Mr. Greene to state and federal regulatory authorities from 1999 to the present; and (2) any and all transcripts of Mr. Greene's testimony at hearings (adjudicatory or non-adjudicatory) before state and federal regulatory authorities from 1999 to the present.

Response

Please see the following attachments:

a. Attachment NSTAR-SEBANE-1-1 (a), *The Changing Face of Renewable Energy*, Presentation to US Environmental Protection Agency

b. Attachment NSTAR-SEBANE-1-1 (b), Prefiled Testimony of Andrew G. Greene, Vermont Public Service Board, Docket No. 6812

c. Attachment NSTAR-SEBANE-1-1 (c) Vermont Public Service Board, Docket No. 6812, Hearing Transcript, September 16, 2003

d. Attachment NSTAR-SEBANE-1-1 (d) Vermont Public Service Board, Docket No. 6812, Hearing Transcript, September 17, 2003

Information Request NSTAR-SEBANE-1-2

Provide copies of any and all regulatory decisions addressing the issues covered by Mr. Greene in testimony provided in response to Information Request NSTAR-SEBANE-1-1. Identify the decision making authority, docket number, year of the decision, and any official citation to the decision.

Response

Please see the following attachment:

a. Attachment NSTAR-SEBANE-1-2 (a), Petition of Entergy Nuclear Vermont Yankee, LLC, State of Vermont Public Service Board, Docket No. 6812 (March 15, 2004).

Please note that the attachment constitutes a bulk document. Accordingly, only two (2) copies are being provided to the Department.

Information Request NSTAR-SEBANE-1-3

Please identify all documents relied upon by Mr. Greene in preparing this testimony. Please provide a copy of each identified document.

Response

Mr. Greene relied on the following documents:

- the Direct Testimony of Henry C. LaMontagne
- the standby rate tariffs filed by NSTAR
- NSTAR's current rate tariffs
- NSTAR's response to DTE-NSTAR-1-2
- Standby Rate Analysis spreadsheet, provided as NSTAR-SEBANE-1-5 (a),
- Load shapes for large office building and grocery from Itron, Inc. The load shapes are incorporated into the Standby Rate Analysis spreadsheet at tab "NE_Building Load_noDG". They are also available at no charge, upon registration, at http://capabilities.itron.com/eShapes/
- Insolation data for Boston from the National Renewable Energy lab. The data are incorporated into Standby Rate Analysis spreadsheet at tab "200 kW PV by insolation." They are also available at: http://rredc.nrel.gov/solar/old_data/nsrdb/hourly/1990/14739_90.txt .
- Mass. Gen. Laws, c. 164, sec. §1G(g)

Information Request NSTAR-SEBANE-1-4

Please provide a copy of any and all articles, papers, speeches or other reports prepared in whole or in part by Mr. Greene addressing, distributed generation, standby rates and/or rate design.

Response

Please see the following attachments:

a. Attachment NSTAR-SEBANE-1-4 (a), *Rays that Pay: Grid-Connected PV Reduces Electricity Cost by Tapping Old and New Value Drivers*, presentation to Boston Area Solar Energy Association.

b. Attachment NSTAR-SEBANE-1-4 (b), *Emissions Market Opportunities for Smaller-Sized Combined Heat and Power Projects: New Value is on the Horizon*, presentation to PowerGen International

c. Attachment NSTAR-SEBANE-1-4 (c), *What Color is Your Electricity?*, Public Utilities Fortnightly, July 1, 2002.

Please also see Attachment NSTAR-SEBANE-1-1(a), *The Changing Face of Renewable Energy*, Presentation to US Environmental Protection Agency.

Information Request NSTAR-SEBANE-1-5

Referring to page 8, lines 13-16, please provide a copy of the referenced "extensive spreadsheet model." Please provide a copy in both paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Please see the following attachment:

a. Attachment NSTAR-SEBANE-1-5 (a), Standby Rate Analysis spreadsheet.

Please note that the attachment constitutes a bulk document. Accordingly, only two (2) copies are being provided to the Department.

Information Request NSTAR-SEBANE-1-6

Referring to page 8, line 18 through 20, please provide: (a) a detailed explanation of the development of the load profiles set forth in Figures 1 through 4, including all assumptions, inputs and data sources (including, the manner in which the "load shapes available from ITRON, Inc." were used); and (b) a copy of all calculations, workpapers, spreadsheets or other documents that the model used to develop Figures 1 through 4. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

The load profiles depicted in Figures 1 through 4 were developed entirely within the spreadsheet model submitted in response to NSTAR-SEBANE-1-5 (on separate tabs) through the following six-step process:

1. Large "wholesale club" style warehouse stores were identified as potential host sites for large PV installations (exceeding 60kW) based on the installation of several PV systems to date (all below 60 kW) in Massachusetts and the Northeast generally at such facilities and sufficient roof space to accommodate a 200 kW DC system (approximately 20,000 square feet). These stores tend to average about 100,000 sq. ft, and, for load definition purposes, are best described as "grocery stores" because the sale of packaged food is a major product line. Like traditional supermarkets, these facilities have significant amounts of refrigeration/freezer equipment and store lighting in use.

2. NCI relied on industry reference data for hourly load profiles typical of a large New England grocery store. NCI obtained this data from ITRON, Inc and used it to develop the hourly loads shown on the top half of the tab "NE_Building Load_noDG" of the spreadsheet model. The ITRON data provide energy consumption figures per square foot over each hour of the year (2003). The data have been scaled to the assumed 100,000 square foot size of the store. The ITRON data can be downloaded from the ITRON website: http://capabilities.itron.com/eShapes/ (There is no charge for registration or downloading).

   A similar approach was used to develop the load data for the large office building (scaled to a 318,000 square feet building), again relying upon ITRON for the load shape of a typical large office building in New England. (This building size was

selected so as to produce annual load requirements similar to the large grocery store, thereby facilitating comparisons between the two cases that focus on the load shape differences.) The office building load data are on the bottom half of the tab "NE_Building Load_noDG" in the spreadsheet model. The spreadsheet has a "toggle" switch to allow the user to alternate between the grocery store load data and the large office building load data. The toggle switch is on the "Summary" tab of the spreadsheet model in cells B28 and C28. Placing a "1" in cell B28 and a "0" in cell C28 activates the grocery store profile. The reverse activates the large office building profile.

3. As described in my testimony, the PV output for both the office building and large grocery store are based on an assumed 200 kWp DC- sized system (equal to 178 kW AC, after conversion losses are taken into account).

4. The hourly pattern of PV production was developed by using the most recent insolation data for the Boston area (1990) available through the Renewable Resource Data Center, maintained on the web by the National Renewable Energy Laboratories (http://rredc.nrel.gov/solar/old_data/nsrdb/hourly/1990/14739_90.txt). The hour with the highest irradiance (955 watts per square meter) was 12 pm on July 7th. This peak level of irradiance was set equal the 178 kW AC maximum output of the PV system; the PV output in all other hours was calculated based on a linear relationship -- the given hour's irradiance relative to the peak of 955 watts per square meter. This resulting ratio was multiplied by the 178 kW AC maximum output of the solar panel to compute hourly PV production.

5. The day selected (manually) for each graph occurs when the peak 15-minute metered billing demand (net of the PV output) takes place in the months of January, April, July, and October, chosen to provide a seasonal representation.

6. Each seasonal graph plots hourly (1) metered load without PV; (2) metered load with PV; and (3) PV output.

Information Request NSTAR-SEBANE-1-7

Referring to page 9, lines 3-7, please provide the load profile for the referenced example in the format set forth in Figures 1 through 4. Include in this response: (a) a detailed explanation of the development of the load profiles, including all assumptions, inputs and data sources (including, the manner in which the "load shapes available from ITRON, Inc." were used); and (b) a copy of all calculations, workpapers, spreadsheets or other documents that were used to develop the figures. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Please see the response to NSTAR-SEBANE 1-6.

Information Request NSTAR-SEBANE-1-8

Referring to page 12, lines 5-6, please provide the basis for the statement that the referenced capacity factor of 16.41 percent for the PV array "is typical of such systems in the Boston area. Please provide a copy of any and all documents that relate to this response.

Response

Based on Mr. Greene's various client engagements and project experience, a capacity factor of 16.41 (after AC conversion is taken into account) is typical of values realized in the Boston area for flat plate, fixed axis installations. A similar figure (17%) is cited in a report prepared for the Massachusetts Technology Collaborate by Arthur D. Little. See http://www.mtpc.org/RenewableEnergy/ADL_Report_p1.pdf

Information Request NSTAR-SEBANE-1-9

Referring to page 12, lines 7-9, please provide the referenced "[c]ost and operating data". Please provide a copy of any and all documents that relate to this response, including, but not limited to "industry reference documents" and any record of "discussions with regional PV generators".

Response

The cost and operating data for the assumed PV systems are shown on the "inputs" tab of the spreadsheet model. Please see the response to NSTAR-SEBANE-1-1(a), *The Changing Face of Renewable Energy*, Presentation to US Environmental Protection Agency, p. 9, for supporting information on the cost profile of commercial PV systems. The input information relating to the PV system was reviewed by telephone with owner/operators of PV systems in the Boston area including Conservation Services Group, Inc. and the General Services Administration of the U.S. federal government.

Information Request NSTAR-SEBANE-1-10

Referring to page 13, Table 1, please provide: (a) a detailed explanation of each calculation that resulted in the values set forth in the table; and (b) a copy of all calculations, workpapers, spreadsheets or other documents that show each calculation that resulted in the values set forth in the table. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Table 1 summarizes the data included on Tables 2-5 of my prefiled testimony, and shows the change in bill savings for the illustrative large grocery store and large office building depicted in the spreadsheet model (outfitted with either a 200 kWp dc PV system or a 200 kW dc baseloaded generator set) stemming from the imposition of the proposed standby tariffs relative to the existing commercial tariffs. The calculations on Table 1 were performed manually.

Information Request NSTAR-SEBANE-1-11

Referring to page 13, lines 5-8 and the reference to bill savings in the example being reduced by "16% to 26%", please provide data and calculations showing: (a) the percentage of savings that would remain; (b) the resulting dollar savings for the customer; and (c) the amount of energy (in kilowatt-hours) and demand (in kilowatts) that would be saved.

Response

BECo Customer Type (current rate is T-2; new rate is SB-1)	% of bill savings under T-2 rate remaining after standby rate imposed	$ Savings remaining with standby rate	Annual kWh savings	Average monthly billing demand reduction (kW) for Distribution	Average monthly billing demand reduction (kW) for Transmission
Grocery w/ PV	84.1%	$19,700.73	255,547	6.29	20.6
Grocery w/ GenSet	82.3%	$112,017.98	1,557,512	0	177.8
Office w/ PV	74.4%	$21,160.89	255,547	5.37	45.9
Office w/GenSet	82.3%	$112,017.98	1,557,512	0	177.8

The data in the table above were obtained from the spreadsheet model. As noted in response to NSTAR-SEBANE-1-6 it is necessary to "toggle" between the grocery and the office building, and the PV and GenSet profiles in the spreadsheet model. As shown in the table above, the amount of bill savings realized under BECo's T-2 rate (from the use of the DG systems) that would remain if the standby charges were imposed ranges from 74.4 to 84.1 percent. The amount of the dollar savings remaining with the standby rate is also shown. It should be noted that "savings" is with regard to electricity bills from NSTAR – it does not reflect the costs associated with owning and operating the DG technology, and therefore is not the "net" savings of operating the DG systems.

With regard to the demand savings in kW, there are two figures to note. The proposed standby rate would allow the customer to retain the full benefit of demand reduction pertaining to transmission charges. This figure is noted in the last column on the right of

the table. For the GenSet (which is assumed to operate at 100% capacity factor) this demand reduction is simply equal to the ac capacity of the equipment – 177.8 kW. There is no demand reduction benefit realized for distribution charges after the cost of standby service is considered. The 178.8 kW output of the GenSet reduces the distribution charges, but is fully offset by the standby charge.

Given the intermittent nature of the PV system, the demand reduction benefit depends significantly on when metered demand peaks occur. The figures shown in the table above for transmission demand reduction vary between the office and the grocery store because the office demand peak is more closely correlated with the PV production profile. Therefore, the PV system has a larger kW effect in reducing transmission demand for the office building. With regard to distribution demand reduction, the situation for PV differs than in the GenSet case. Unlike the GenSet, which is assumed to operate uniformly, the PV output is intermittent, based on the insolation data used to create the production profile. Even with the standby rate, there are some minor distribution demand charge savings (about 5-6 kW per month). This occurs because, in some months, the PV output will alter the specific hours in which the demand meter registers peak demand relative to the hours that would have set demand levels without the PV system.

Information Request NSTAR-SEBANE-1-12

Referring to page 14, lines 5-9, please provide the basis for the statements that the Boston Edison standby rate would reduce the internal rates of return for the PV installations from 12 percent to 10 percent for the large grocery store and from 14 percent to 11 percent for the large office building. Please provide a copy of all calculations, workpapers, spreadsheets or other documents that show each calculation. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Please refer to the spreadsheet model tabs "BECo_Cashflow_T2" and "BECo_Cashflow_SB1". The internal rates of return for each scenario are shown. The "PV toggle" on the Summary tab must be switched with a "1" to provide the IRRs for the PV cases.

Information Request NSTAR-SEBANE-1-13

Referring to page 14, lines 5-9, please provide the IRR that Mr. Greene believes is needed in order to convince customers to proceed with DG installations. Please provide supporting documentation for the specific IRR that Mr. Greene believes is necessary.

Response

The necessary IRR for a customer to proceed with a DG installation is not uniform. Acceptable financial returns and willingness to undertake a DG project for potential DG customers can vary quite significantly based on such factors as the customer's: perception of applicable technical, regulatory and market risks; available capital; long-term plans for operation at a given location; assumptions about the resale value of DG equipment; and time and effort required to complete a DG system, among other factors. A higher IRR will always make the decision to install DG more attractive; a lower IRR makes it less so.

From my experience with the PV market, owner/operators are generally seeking an IRR higher than either the 11 or 14% figures cited in my testimony. From my experience with potential customer-generators, many are seeking an IRR above 20% to gain corporate approval to proceed with DG projects. Some customer-generators are willing to install PV with a lower IRR because of the environmental and other benefits of PV. However, IRR is still important to these customers, and the reduction in IRR caused by the proposed standby rate could be a significant factor in their decision whether to install PV.

Information Request NSTAR-SEBANE-1-14

Referring to page 16, Table 2, please provide: (a) a detailed explanation of each calculation that resulted in the values set forth in the table; and (b) a copy of all calculations, workpapers, spreadsheets or other documents that show each calculation that resulted in the values set forth in the table. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Please see the spreadsheet model provided in response to NSTAR-SEBANE-1-5.

Information Request NSTAR-SEBANE-1-15

Referring to page 17, Table 3, please provide: (a) a detailed explanation of each calculation that resulted in the values set forth in the table; and (b) a copy of all calculations, workpapers, spreadsheets or other documents that show each calculation that resulted in the values set forth in the table. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Please see the spreadsheet model provided in response to NSTAR-SEBANE-1-5.

Information Request NSTAR-SEBANE-1-16

Referring to page 18, Table 4, please provide: (a) a detailed explanation of each calculation that resulted in the values set forth in the table; and (b) a copy of all calculations, workpapers, spreadsheets or other documents that show each calculation that resulted in the values set forth in the table. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Please see the spreadsheet model provided in response to NSTAR-SEBANE-1-5.

Information Request NSTAR-SEBANE-1-17

Referring to page 19, Table 5, please provide: (a) a detailed explanation of each calculation that resulted in the values set forth in the table; and (b) a copy of all calculations, workpapers, spreadsheets or other documents that show each calculation that resulted in the values set forth in the table. The copy should be provided both in paper form and electronically. The electronic version should be in Excel format and show all inputs, formulas and linked sources.

Response

Please see the spreadsheet model provided in response to NSTAR-SEBANE-1-5.

Information Request NSTAR-SEBANE-1-18

Referring to Mr. Greene's testimony on the application of standby rates to renewable sources of power (at pages 20-24), does Mr. Greene recommend that all sources of renewable power, as that term is defined in the Electric Restructuring Act of 1997, Chapter 164 of the Acts of 1997, should be exempt from paying standby service charges? Does Mr. Greene recommend that there should be any specific size threshold for such an exemption for renewable power? Does Mr. Greene recommend that such an exemption should be limited to only certain types of renewable power? Please explain in detail.

Response

As noted in my testimony, the Company has not demonstrated a need for any form of standby service rate at this time, and its filing does not provide a proper context or support for imposing standby charges on DG without also investigating the many potential benefits associated with DG technologies, such as photovoltaics.

As I stated in my testimony, if the Department chooses to approve some form of a standby rate in this proceeding, elective exemptions should be provided under specified conditions to support the policy objectives articulated by the Legislature in the Electric Restructuring Act of 1997, Chapter 164 of the Acts of 1997, among other legislative provisions. In my testimony, I recommended that MTC-eligible resources be granted an elective exemption from any standby rate that the Department might approve in this proceeding. This definition would include all renewable energy technologies as that term is defined in M.G.L. c. 40J, §4E(f). Consistent with this legislative definition, I do not recommend any further restrictions on technology type or scale.

Information Request NSTAR-SEBANE-1-19

Referring to page 19 and Mr. Greene's statements regarding "exit fees" and the provisions of G.L. c. 164, §1G(g), is it Mr. Greene's opinion that NSTAR Electric's proposed standby rates are "exit fees" within the meaning of the cited statutory provision? Please provide the basis for Mr. Greene's opinion.

Response

The reference in my testimony to G.L. c. 164, §1G(g) and its provisions for recovery of "exit fees" from on-site generators, was presented for the sole purpose of demonstrating that the Legislature has previously considered the question of utility revenue erosion relating to on-site generators and established parameters that should, at the very least, be instructive in this proceeding.